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## CALCULUS.

Solutions of Problem 172 have been received from J. E. Sanders, Hackney, Ohio, and J. B. Gregg, M. Sc., C. E., Senecaville, Ohio.

173. Proposed by J. E. SANDERS, Hackney, Ohio.

Find the greatest ellipse that can be inscribed in a quadrant of a given circle.

Solution by J. B. GREGG, M. Sc., C. E., Senecaville, Ohio, and G. W. GREENWOOD, B. A. (Oxon), Professor of Mathematics and Astronomy, McKendree College, Lebanon, Ill.

By symmetry, the radius bisecting the quadrant will coincide with an axis of the ellipse. Denote the length of this semi-axis, and that of the transverse semi-axis, by  $a$ ,  $b$ . Then

$$\pi ab = \text{area of ellipse} = A \text{ (say).}$$

$$a + \sqrt{a^2 + b^2} = \text{radius of given circle} = r \text{ (say).}$$

$$\therefore r^2 = 2ar + b^2.$$

$$\text{Since } A \text{ is a maximum, } bda + adb = 0. \text{ Also } rda + bdb = 0.$$

$$\therefore ra = b^2, r = 3a, A = \frac{1}{3}\pi r^2 \sqrt{3}.$$

Also solved by G. B. M. Zerr, A. M., Ph. D., Parsons, W. Va., and A. H. Holmes, Brunswick, Me.

## MECHANICS.

163. Proposed by W. J. GREENSTREET, A. M., Editor of The Mathematical Gazette, Stroud, England.

A particle  $A$ , mass  $m$ , rests on a smooth horizontal plane and is attached by two inelastic strings to masses  $m_1$ ,  $m_2$  at points  $B$  and  $C$  such that  $BAC$  is a right angle. If a blow is given  $A$  at an angle  $\theta$  to  $AB$ , find the initial direction of motion of  $m$ , and equations for initial motion of the particles  $m_1$  and  $m_2$ .

Solution by J. B. GREGG, M. Sc., C. E., Senecaville, Ohio.

Let  $v$ ,  $v_1$ , and  $v_2$  be the respective initial velocities of  $m$ ,  $m_1$ , and  $m_2$ , and let  $\phi$  be the angle which the initial motion of  $m$  makes with the line of direction of the blow. Construct  $AD = v$ ; then  $DE$  perpendicular to  $BA$  produced  $= v_2$ ,  $AE = v_1$ ,  $\angle DAE = \theta + \phi$ .

$$v_1 = v \cos(\theta + \phi), v_2 = v \sin(\theta + \phi), mv \sin \phi + m_1 v_1 \sin \theta = m_2 v_2 \cos \theta.$$

$$\text{Solving for } \phi, \tan \phi = \frac{(m_2 - m_1) \sin \theta \cos \theta}{m - m_1 \sin^2 \theta - m_2 \cos^2 \theta}.$$

## DIOPHANTINE ANALYSIS.

116. Proposed by HARRY S. VANDIVER, Bala, Pa.

If  $n$  is an odd positive integer, and  $1, n, n', n'', \dots$  denote all its distinct divisors, then  $2^n > 2(n+1)(n'+1)(n''+1)\dots$

II. Solution by the PROPOSER.

By Euler's generalization of Fermat's Theorem (Dirichlet-Dedekind Zah-